A TREATISE

ON

PUNCHING AND SHEARING MACHINES.

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MANUFACTURERS OF THE

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AND

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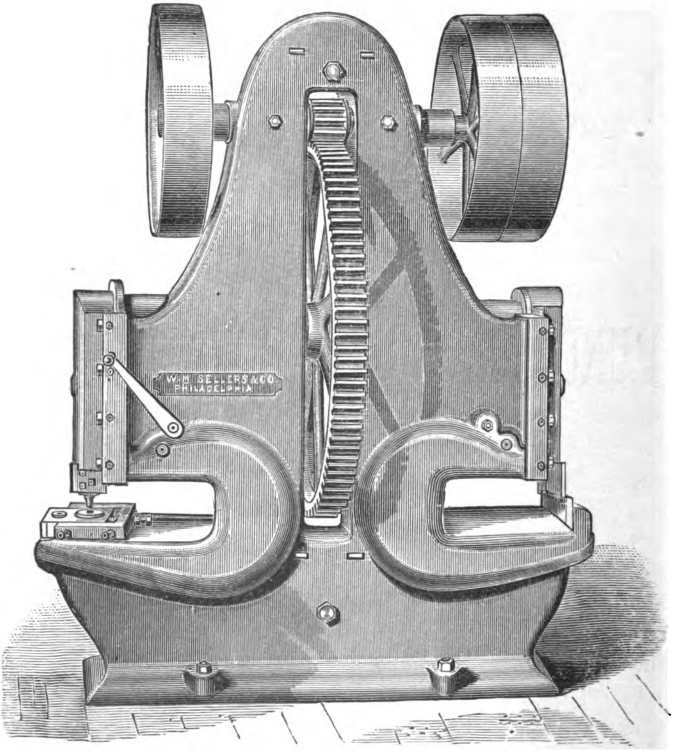
PUNCHING AND SHEARING MACHINES.

FIG. 1.



PUNCHING AND SHEARING MACHINE COMBINED.

PUNCHING AND SHEARING MACHINE COMBINED.

Punch and shears driven from the same shaft; independent stop motion to each, so that they will always rest at their highest point; can punch a 2-inch hole in the centre of a $\frac{5}{16}$-inch plate 35½ inches in diameter, and can shear ¾-inch plates in width 20½ inches; overreach of jaw 20 inches for rivet punches and shears, and 17¾ inches for washer punches.

IN designing this machine the requirements of ordinary boiler work were kept in view. The shear is intended for cutting plate iron of usual thickness for boilers; will shear ¾-inch plate. The punching side has its dies so arranged in a holder as to permit the punching of flanges of boiler heads which are as small as 12 inches in diameter; the punching being done from the outside or marked side of the head, and flanges turned out on end of flues can be punched vertically. We send with each machine a sample set of punches and dies intended for boiler plate of ⅜-inch thickness, on which it will be seen that the holes in the dies are made larger than the punches by the following formula, expressing the diameter and thickness in sixteenths of an inch.

Punching boiler heads.

Sample punches and dies.

The diameter of the die hole = diameter of punch, plus $\frac{2}{10}$ the thickness of the plate ($D = d + 0.2\ t$). Thus, for iron plate $\frac{6}{16}$ of an inch thick, the diameter of the punch being $\frac{13}{16}$ of an inch, the diameter of the die hole will be 14.2 sixteenths of an inch,—say ⅞ inch. This method of making the die hole larger produces a taper hole in the plate, but allows the punching to be done with less consumption of power and, it is said, with less strain on the plate. We do not adapt any strippers to this machine, as the character of work makes it necessary for the users to arrange them to suit their special work. To run these

Formula for size of die hole.

No strippers sent with machines.

Speed.

machines efficiently, the fast and loose pulley on the machine should make at least 120 revolutions per minute: this will punch 12 holes to the minute; if a faster speed is admissible on the work, the speed of pulleys can be increased. Determine number of punch strokes to the minute, and multiply by ten for speed of pulleys. By means of the independent stop motion, one stroke can be made at a time on either side of the machine without stopping the machine itself, or interrupting the work being done on the other side. In this respect it is as convenient as two entirely distinct machines.

Double punching machine.

We can arrange it also with punch in place of the shear blades. It is then a double punching machine, admirably adapted for punching nuts, the holes in the bar being punched on one side of the machine and the nuts punched out on the other side.

The power of this press is sufficient to punch a 2-inch hole in $\frac{5}{16}$ iron plate, and to shear $\frac{3}{4}$-inch plate.

Crank motion punching machine.

We also arrange from same pattern a punch and shear with less overreach; the shear blades placed for cutting off light bar iron, and the punch side arranged for washer punching, or the punching of $\frac{3}{4}$-inch thick bars for car work. When single punches or shears are required, we can stop off part of the frame and produce independent machines, useful for some special purposes, when it is required for convenience to have the punch and shear in separate parts of the workshop.

The punching machine alone arranged in this manner has frequently been used for punching rail ends, and may also be advantageously employed as a washer punching machine.

PUNCHING AND SHEARING MACHINES OPERATED BY LEVER.

WE have introduced various punching and shearing machines arranged with a heavy wrought iron lever to work the vertical slide. The lever being moved by a cam on the driving shaft. This form of machine we recommend for the following reasons:

It is evident that in all punching or shearing machines driven by a belt, there must be a conversion of the rotary motion of the driving pulley into a reciprocating motion of the punch or shear blade.

Pressure on crank.

To obtain the requisite power, many revolutions of the driving pulley must occur to one stroke of the punch. In crank machines, the whole pressure of the cut comes directly on the crank pin, which must perform a good portion of its revolution under this heavy strain at whatever speed the crank shaft may be running. This limits the power of such machines to the practical pressure sustainable on a given surface at a given velocity. When the vertical slide which carries the punch is operated by a lever, the sliding motion of the part of the lever in contact with the vertical slide is almost inappreciable: the pressure extends over large surface with little motion; so with the fulcrum pins over which the lever works; with very little and very slow motion of these parts much pressure is admissible, while the long end of the lever is operated upon by the lifting cam acting under comparatively light pressure. Added to this economical use of power, with diminished frictional resistance, comes the possi-

Less friction with lever machine.

bility of so shaping the cam which lifts the lever as to cause the motion of the punch to be uniform through the whole length of the stroke, to return quickly, and then to dwell during any required portion of the revolution of the cam-shaft at the top of its stroke. Therefore, in comparing machines using the crank or eccentric with those employing the lever and cam, if in both cases the same pulley, belt, and gearing is used, running at the same rate of speed, and making the same length of stroke at the punch or shear blade, it will be found that there is a capability of punching larger holes or of shearing thicker plates when the cam and lever are used than when the crank or eccentric is employed.

Quick return to punch.

Lever machine less friction than the crank.

On the lever punch and shears, as now made by us, is arranged a four-toothed clutch on the main shaft, to be used in stopping and starting the plunger. This admits of quicker work than when the cam is shifted on the main shaft. The tail end of the lever is made to drop on a block of wood held in a box at the back of the machine, and the adjustment of the length of block to limit the fall of the lever enables the stroke to be controlled, and in thin metal to carry the punch close to the plate with less drop than when thicker iron is being punched, so obtaining a longer dwell for setting the plate.

Clutch to stop the motion.

Regulation for the stroke.

We have quite recently added important improvements to all our punching and shearing machines in the direction of increased strength and greater efficiency, much extending their range of usefulness. Prominently among these improvements we will mention, so arranging the lever machines as to make them, when desired, do the punching and shearing on one and the same machine. Heretofore all attempts

Interchangeable lever machines.

at an interchangeable single punching or shearing machine have been unsatisfactory. Shearing machines with punching attachments have been made, but one or the other device has been at the best a make-shift, not very satisfactory and yet useful, inasmuch as it has enabled one machine to do both kinds of work where there is not enough of both kinds to make the purchase of separate machines advisable. To meet this want we have now perfected interchangeable machines, which can be used for either kind of work, and when in use for either is at that time perfect in all its appointments, as much so as if built for that purpose only. The change from one to the other is as readily effected as the change of blades in a shearing machine or of punches in a punching machine.

Improved punch or shears.

While we do not fit up all these machines to be interchangeable, the extra cost of the machines so arranged is so little above the cost of the machines for one kind of work only, that it may be in some cases quite advantageous to use these machines where independent machines are employed, as they can then be, any or all, used on whatever work is the most pressing. To aid in the selection of the machines for various purposes which we make with levers in one housing, we append a list, with their capacities, before describing them in detail.

Advantages.

LEVER SHEARING MACHINES.

Shearing machine, 26 inches over-reach, will shear plates 15/16 inch thick.

Shearing machine, 33 inches over-reach, will shear plates 15/16 inch thick.

Shearing machine, 23¾ inches over-reach, will shear plates 1½ inches thick.

Bar shearing machine, capable of cutting iron 6 inches by 1½ inches.

Plate shearing machine, with 12 inches stroke, making cut 60 inches long, capable of shearing 1 inch iron plate, over-reach for edges of long plate 7 inches, will cut across plates 5 feet wide at any point of their length.

Lever shear for angles, will cut 6 inches by 6 inches by 1½ inches angles square without spoiling the crop end.

LEVER PUNCHING MACHINES.

Lever punching machine, with 26 inches over-reach, will punch 2-inch hole in iron ½ inch thick.

Lever punching machine, with 33 inches over-reach, will punch 2-inch hole in iron ½ inch thick.

Lever punching machine, with 22 inches over-reach, will punch 2-inch hole in iron 1½ inches thick.

Bar punching machine, with 7 inches over-reach, will punch 2 inch hole in iron 1½ inches thick.

LEVER MACHINES FOR EITHER PUNCHING OR SHEARING.

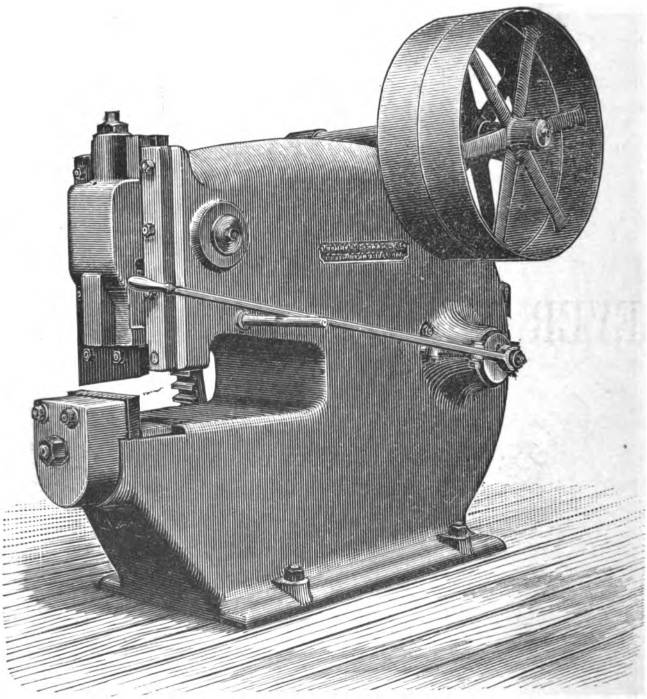
With 26 inches over-reach, shearing 15/16 inch iron plates and punching 2-inch hole in iron ½ inch thick.

With 33 inches over-reach, shearing 15/16 inch iron plates and punching 2-inch hole in iron ½ inch thick.

Bar shear, to cut 6-inch by 1½-inch iron and to punch 2-inch hole in iron 1½ inches thick.

LEVER SHEARING MACHINES.

Fig. 2.



LEVER SHEARING MACHINE.

SHEARING MACHINE.

Shear blades placed so as to be right for trimming edges of plates, not for cutting bar iron. Operated by a heavy wrought iron lever within the housing. Independent stop motion by means of a four-toothed clutch in the housing. Blades rest open when clutch is out of gear. Vertical motion of blades 1½ inches. Can be used to shear plates of iron $\frac{15}{16}$ inch thick. Fast and loose pulleys on the machine 36 inches diameter, 7 inches face, which should make 114 revolutions per minute.

We make two sizes of this machine, namely:

Shear, with 26 inches over-reach, to slit through the middle plates 52 inches wide.

Shear, with 33 inches over-reach, to slit through the middle plates 66 inches wide.

FOR remarks on the theory of the operation of these machines, see page 8. The heavy wrought iron lever in the housing raises the blade by its gravity, and the cam which moves the lever is so shaped as to cause the motion of the blade in cutting to be at a uniform rate of speed. Returning quickly it dwells for some time at the top of its stroke, thus giving ample time to shift the plate for the next cut.

Motion of blades uniform.

Shifting cam.

In our earlier machines we moved the lifting cam sideways from under the lever when it was desired to stop the machine. This could only be done when the cam was free from pressure at the end of the stroke, and in starting again the cam could only be pushed in when in proper position in regard to the lever. We now keep the cam in position under the lever and attach it to or detach it from the shaft by means of a four-toothed clutch, which while it can only be withdrawn at the completion of the stroke, yet at the same time it will permit the starting again to be effected in

Stopping by means of clutch.

any one of four positions of the driving wheel in relation to the cam, thus saving much time and also preventing the damage to the machine likely to arise from working the cam only partly under the lever.

SHEARING MACHINE FOR 1½-INCH PLATES.

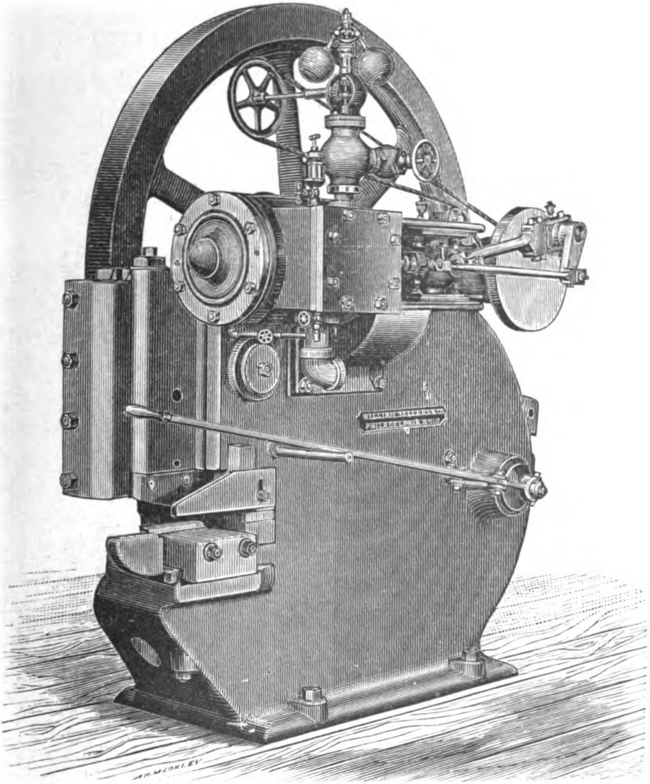
Shear blades placed so as to be right for trimming the edges of plates, not for cutting bar iron. Operated by heavy wrought iron lever within the housing. Independent stop motion by means of a four-toothed clutch in the housing. Blades rest open when the clutch is out of gear. One pulley only on the machine, 42 inches diameter, 12 inches face, making 120 revolutions per minute. The belt should be double.

THIS tool is admirably adapted for plate-work in car-shops, and is the mate to a punching machine, see page 31, which is for iron of the same thickness, and these machines cover much of work on draw irons and the like. It is usual to place these machines near to the main line and drive direct without any counter-shaft, as the blades can be stopped by the clutch in the machine. For repairs it is simpler to throw off the belt than to provide any means of shifting the belt. This and similar shearing machines or punching machines can be operated by an engine attached to the machine when such application is desirable. The manner of attaching the engine is shown on page 15.

No counter-shaft.

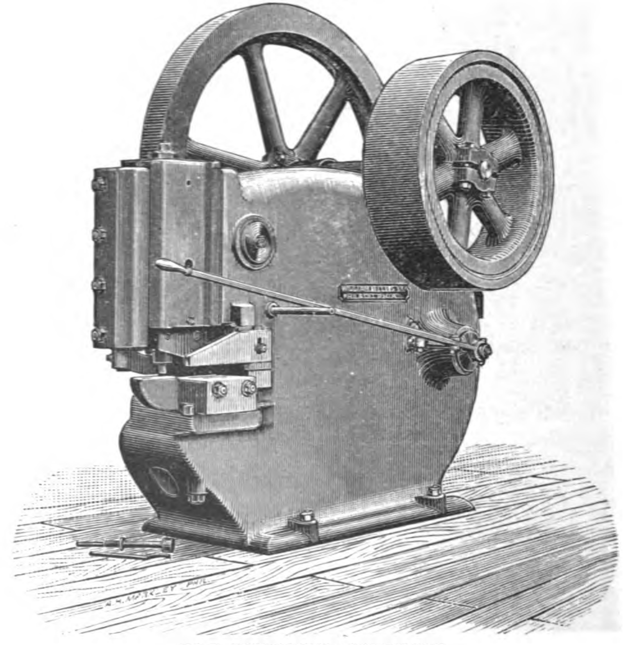
Engine attached when required.

FIG. 3.



BAR SHEARING MACHINE.
DRIVEN BY INDEPENDENT ENGINE.

FIG. 4.


A. H. MARKLEY PHIL.

BAR SHEARING MACHINE.

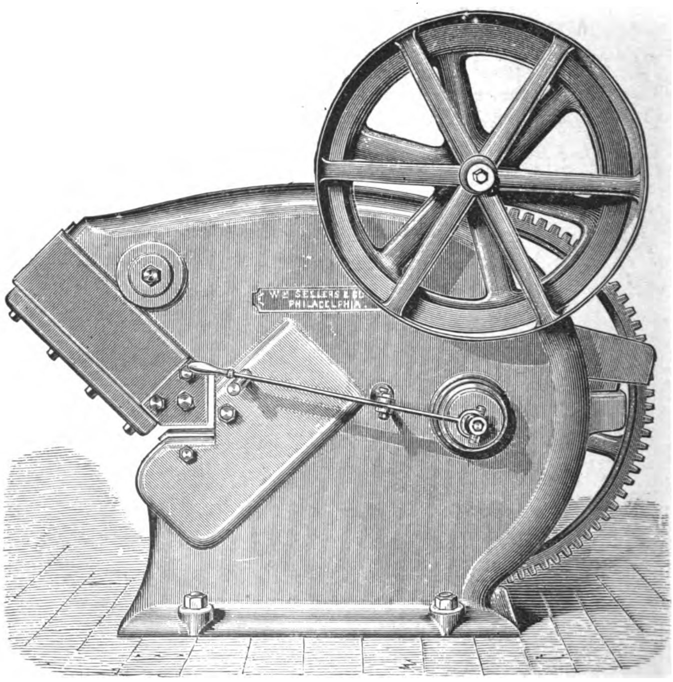
BAR SHEARING MACHINE.

Shear blades placed so as to be right for cutting bar iron and not for trimming plates. Operated by heavy wrought iron lever within the housing. Independent stop motion by means of four-toothed clutch in the housing. Blades rest open when the clutch is out of gear. Is capable of cutting bars of iron 1½ inches thick and 6 inches wide at one stroke. One pulley only on the machine, 42 inches diameter, 12 inches face, which should make 120 revolutions per minute. The belt driving the machine should be double.

THIS has proved itself to be a very efficient tool for cutting bar iron. There is a rest provided on which the bar, resting at the required point of cut, can be pushed under the blades when open without stopping the machine, while, as in all our shearing and punching machines, a very convenient stop motion is provided. We fit the machine with plane blades only, but are prepared to furnish blades for cutting rounds when they are called for. The addition to this machine, of the punching devices already alluded to on page 8, makes it one of the most perfect tools for shearing and punching that has been designed, as each attachment is perfect in its way. We give on page 15, Fig. 3, the bar shear, with or without the punching attachment, as operated by a special steam-engine attached to the machine. This engine is provided with heavy fly-wheel, and is capable of operating the punch to make holes 2 inches diameter in iron 1½ inches thick. The engine has a governor to regulate its speed to the required rate when the machine is running empty and to prevent its racing when through its cut. The examples we give of this machine will serve to show the attachment of an engine to any one of our punching or shearing machines without any further description.

Engine.

FIG. 5.



ANGLE SHEARING MACHINE.

Shear operated by a heavy wrought iron lever within the housing. Independent stop motion, so that the blades will rest open; lower blades in two pieces. Fast and loose pulleys on machine, 42 inches diameter by 7 inches face; speed, 144 revolutions per minute; will shear 6 by 6 inches by ½-inch angles.

ANGLE SHEARING MACHINE.

THE same principle involved in all our improved lever shearing and punching machines obtains in this useful tool. Angles which have been curved or bent before shearing and while resting on trussels may be readily trimmed. The blades have no shear given to their edges; but by punching the angle off with a cut extending over all parts of the iron with a uniform pressure, the piece cut off is not bent out of shape. This is an important feature in the machine, as it enables it to be used in cutting up angles to length without distorting the ends cut off.

Does not distort the end.

It will be observed that the design of this machine is similar to our bar shear and our lever plate shear, as shown on previous pages, and indicates the practicability of adapting the frame of these machines to various purposes, as special punches or shears. We can widen the plunger, or vertical slide of the punching machines, and arrange adjustable punches for piercing four holes in fish plates at one operation. We are also prepared to make horizontal punches for fire-box and boiler-head work, convenient also for punching angle irons. We have also arranged some of our punching machines for the plates of coal screens; and to any of the punching machines we can adapt dividing machines to enable the sheets to be spaced mechanically, making proper allowance for the difference of diameter or circumference of outer or inner sheets in cylindrical boiler work.

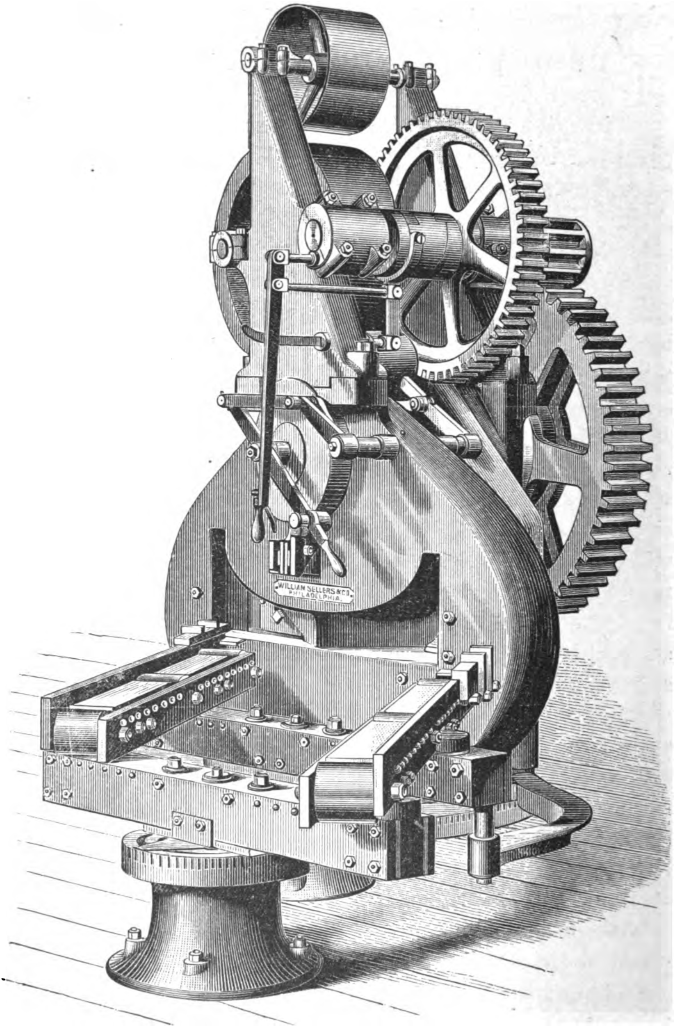
Frame can be adapted to special purposes.

Horizontal punch.

Automatic spacing.

Very much more rapid work can be done when the plates are moved by a spacing device than when laid out with a template and passed through the machine by hand.

FIG. 6.



DUPLEX ANGLE SHEAR.

DUPLEX ANGLE SHEAR.

Operated by heavy crank, which works either one of two diagonal slides carrying the cutting blades for right or left hand cutting. The bars are punched off at one stroke, so as not to distort the crop ends by any shearing motion of the blades, and the machine is powerful enough to cut 6 inches by 6 inches by 1 inch angles, and to make the cut at any angle required in bridge structures from 30° included angle to square. The machine is provided with guiding tables for the angles to rest on, and the entire machine, carrying its guiding tables with it, is made to swing on a centre, so that the presentation to the machine of the angle to be cut is always in the same right line. This arrangement is very economical of room, as the irons taken from the pile are presented in line with the pile, the machine being turned to the required angle of cut, either to the right or the left hand. Pulley on the machine is 36 inches diameter, 12 inches face, and should make 300 revolutions per minute. The machine must be placed under the driving pulley of the line, and the belt is so carried by guiding pulleys on the machine and near to the line driver as will permit the vibration of the machine to its required angle of cut.

THIS is one of the most important of our special tools for bridge building works. The great weight of the machine is carried on a set of anti-friction rollers, such as we use in our turn-tables for turning locomotives or for pivot bridges.

This enables the machine to be turned to the required angle of cut, thus setting the blades to the angle, and not swinging the bars to be sheared to the same angle. This is a very important matter, as involving great economy in shop-room. There are two shearing slides to carry the movable or upper blades, and these are at an angle of 90° to each other, so as to cut the angles as they lie on their flat with one leg vertical, and to make the cut at any required angle of oblique division, from 30° angle to 90°.

Fig. 7.

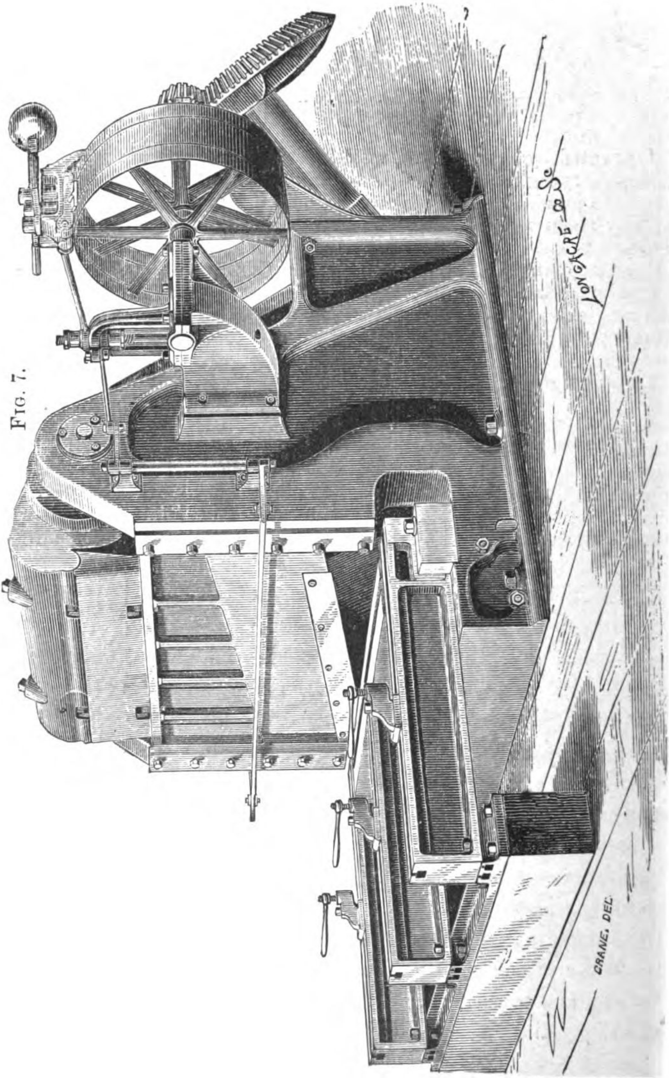


PLATE SHEARING MACHINE.

For trimming edges of long plates, or cutting off to length plates 5 feet wide. Will shear wrought iron plates one inch thick. Upper blade guided vertically in the frame of the machine, and driven down by a pitman as wide as the blade is long; this pitman receiving its motion from a long rocking shaft above it. The driving arm or lever of the machine is a rack segment engaging with the teeth of a spiral pinion similar to the spiral pinion used in our patent planers. The spiral pinion is driven by bevel wheel and pinion and open and crossed belt, after the manner of planing machines. Cutting blade adjustable in length of stroke, returning at double the speed of its down stroke. Counter has 24-inch pulleys, 7-inch face, 272 revolutions per minute.

IN designing this machine, the wants of modern bridge construction and ship-building were in view. The plate clamped to place can be sheared with exceeding exactness, either in trimming the edge of long plates or cutting off plates 5 feet wide and under, to lengths. The driving device is new and very efficient. The blade being at all times under the control of the operator, can be made to cut to any fixed point in its length and then stopped or raised. It is provided with an automatic adjustment to its belt-shifting motion, gauging the length of its stroke. It makes the down stroke, immediately reascends, and stops up, to wait for the readjustment of the plate. A hand rod in front of the machine is convenient to shift the belts and start the cut.

Driving device.

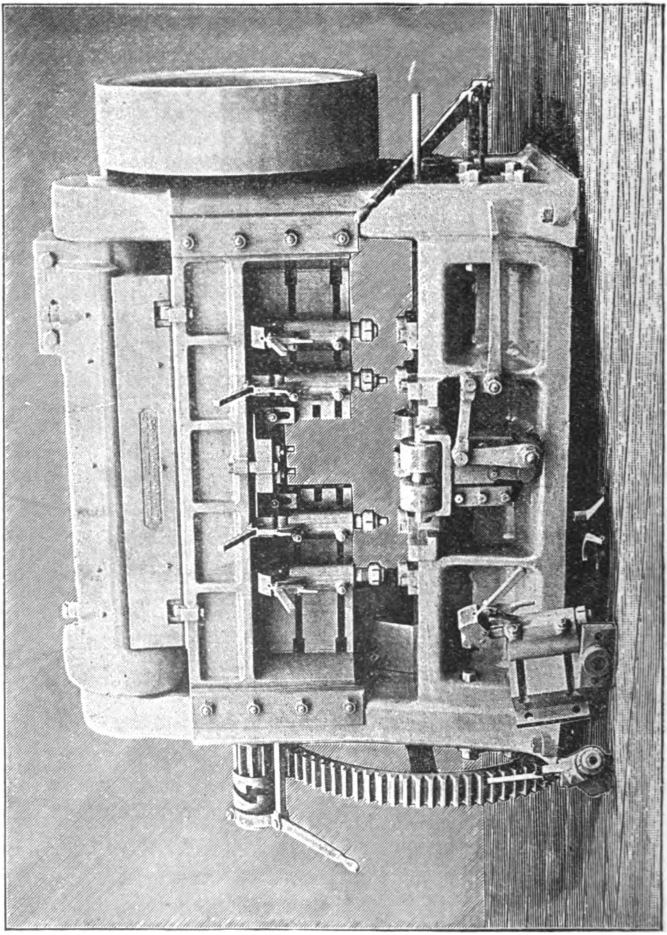
Belt-shifter.

The machine is so constructed as to have its strains all within itself, and is not in any great measure dependent upon stone foundations for its rigidity, other than the proper maintaining of the structure in a level position. The vertical slide is arranged to receive curved blades, and the bed plate, to which the lower blade is attached, is capable of ready removal, to receive a curved bed plate with a shear blade bent to match the curve of the upper blade.

Strains.

Curved blades.

FIG. 8.



MULTIPLE PUNCHING MACHINE.

MULTIPLE PUNCHING MACHINE.

Arranged with a cross-head working in slides between two housings, the sliding cross-head being operated by a long cam extending the full length of the cross-head and driven at one side by lever from a cam on the driving shaft. Width between uprights sufficient for sheets 5 feet 11 inches wide to be passed and be punched on the edges or across the sheet at any point of its length. Can punch sheets as wide as given or two narrower sheets at the same time. Will punch at one operation four angles or two channels. The driving pulley on the machine is 42 inches diameter and 12 inches face. This pulley should make 120 revolutions per minute. With the machine we furnish

Twelve Cylindrical Punch Holders.

Six Side Punch Holders, arranged to work the same as the cylindrical holders, without gearing.

Four Punching Holders, adapted to punching angles.

Apparatus for holding channels and beams, when being punched, consisting of supporting blocks, die holders, and grips 6-inch, 8-inch, 10-inch, and 12-inch sizes.

Four Die Blocks, with holes to one side for angles.

Twelve Die Blocks, with holes central.

One Stripper Bar, for plates.

One set of Angle Strippers.

One set of Blocks for holding adjusting-spring to angle stripper.

Two Angle Grippers.

Three Plate Grippers.

One Spacing Carriage, arranged to space to any multiple of ¼ inch up to 13½ inches.

One Guide Carriage.

Fourteen stands, with rollers complete.

124 feet of geared and 124 feet of plain rack, making a traverse of spacing and guide carriage, each of ~~59 feet.~~ 62 ft.

One Blocking piece.

Two Stands, without rollers.

THE introduction of this very important tool into works fitted for bridge construction marks an important step in progress. Its use enables work to be punched with great accuracy, and insures

Insures accurate spacing.

the possible assemblage of the parts of beam work without any use of the drift or reamer. It is fitted with a heavy cross-head working from a lever and cam, which cross-head is long enough to carry 15 punch holders placed 4 inches from centre to centre. Throw-out mechanism to each punch holder, so that such ones only can be used at a time as is required by the work to be punched. Special right- and left-hand punch holders may also be used, bringing the punches much closer together than 4 inches. The machine will take in, clear of the working lever, plates 5 feet 11 inches wide, and such plates, while being passed through the machine, can have holes punched in continuous rows along the entire sheet at edges or at any part; also at intervals, rows of holes can be punched across the sheet, such punches being only limited in number by the strength of the machine, the number varying with the size of the holes to be punched. There is in the centre of the cross-head of the machine a gap, filled by a block when the machine is used as a Plate Punch, but which block is removed when channels and angles are to be punched, adapting the machine to receive such work to great advantage. Special devices are arranged to receive two channels at the same time, or to carry four angles and punch them at the same time. Thus sheets are punched with the spacing device and then the other members, of say a plate girder, are punched with the same spacing device, as also any pieces to form the top and bottom chords of the beam. This arrangement insures the greatest accuracy of punching, and enables the work to be assembled with a certainty that the rivet-holes will all agree, and the whole operation is performed with certainty and dis-

Punches.

Capacity of the machine.

Gap for channel bar punching.

All parts of one plate girder punched with same spacing device.

patch. The various devices accompanying the machine to enable it to perform this work on the many sizes of channels, angles, and the like are enumerated in the specification at the head of this article. The spacing carriage is peculiar. It has a spacing device which can with great readiness be set to any required distance, in quarters of an inch, from ¼ inch to 13½ inches, inclusive, at one stroke. There are rails and rack furnished for one side of the machine, and plain rails for a trailing carriage on the other side of the machine, with rollers at intervals to sustain the weight of the work being passed through. The spacing carriage is provided with gripping tongs to hold the various pieces it is capable of passing through at one time, as is also the trailing carriage. The machine proper is provided with strippers and clamping devices for the work, such as channels and the like, as enumerated in schedule, and there are lifting rollers to raise the work from the dies so as to clear the fins resulting from the punching and to enable the spacing device to work freely.

Spacing carriage.

Gripping tongs.

Clamping device.

CHANNEL BAR PUNCH.

We make a lever machine somewhat similar to our other lever machines, which is adapted to punching channels, angles, and narrow plates. This machine is fitted with the spacing carriage used with the multiple punch, and will do for the same kind of work, with the exception of wide plates. We illustrate this tool on page 30.

LEVER PUNCHING MACHINE.

Operated by a heavy wrought iron lever within the housing. Independent stop motion by means of a four-toothed clutch in the housing. Punch rests up when clutch is out of gear. Vertical motion of slide 1½ inches. Can be used to punch 2-inch holes in plates of iron ½ inch thick. Fast and loose pulleys on the machine 36 inches diameter, 7 inches face, which should make 114 revolutions per minute.

We make two sizes of this machine, namely:

Punch, with 26 inches over-reach, to punch holes in the middle plates 52 inches wide. Will punch boiler rivet holes 29 inches from edge of plate.

Punch, with 33 inches over-reach, to punch holes in the middle plates 66 inches wide. Will punch boiler rivet holes 36 inches from edge of plate.

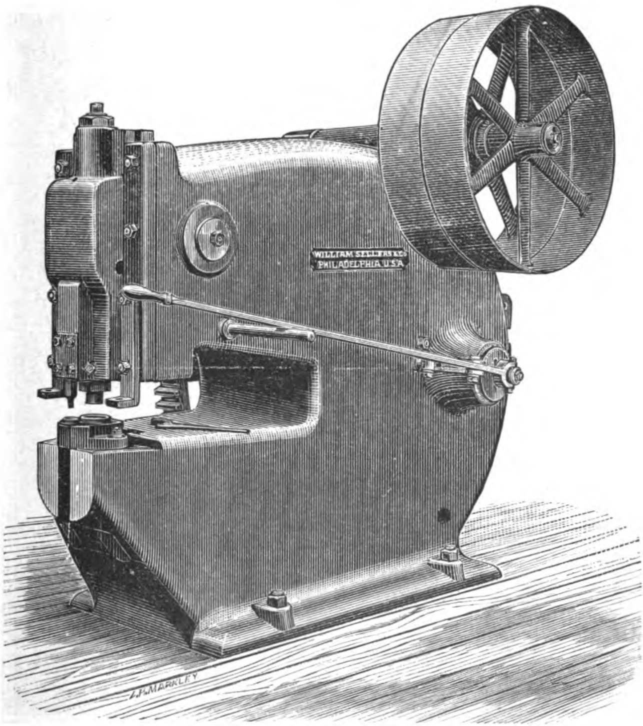
Motion of punch uniform.

FOR remarks on the theory of the operation of these machines, see page 8. The heavy wrought iron lever in the housing raises the punch by its gravity, and the cam which moves the lever is so shaped as to cause the motion of the punch in operating to be at a uniform rate of speed; returning quickly, it dwells for some time at the top of its stroke, thus giving ample time to shift the plate for the next hole.

Stopping by means of clutch.

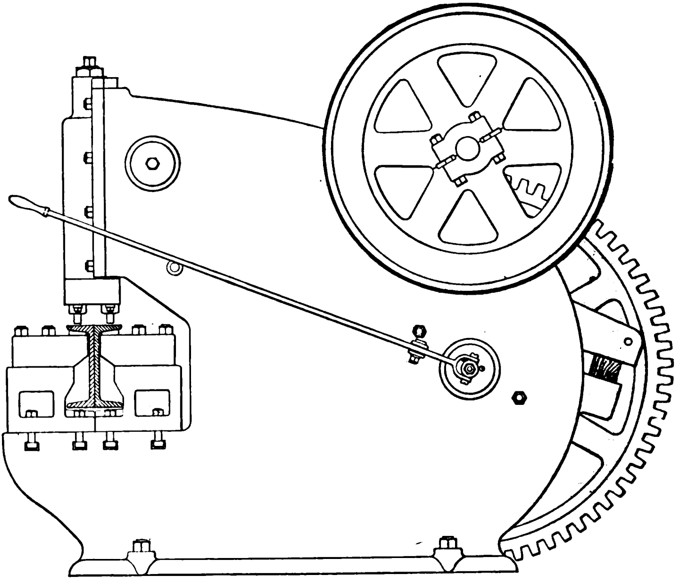
We keep the cam in position under the lever, and attach it to or detach it from the shaft by means of a four-toothed clutch, which while it can only be withdrawn at the completion of the stroke, yet at the same time it will permit the starting again to be effected in any one of four positions of the driving wheel in relation to the cam, thus saving much time, and also preventing the damage to the machine likely to arise from working the cam only partly under the lever.

FIG. 9.



LEVER PUNCHING MACHINE.

FIG. 10.



CHANNEL BAR PUNCH.

THIS machine, mentioned in connection with our multiple punching machine, on page 27, is fitted with the same spacing device as is described on the same page, and with it we furnish a number of the special devices mentioned on page 25. While it will not do the work on wide plates that is accomplished by the larger machine, yet it will, in the same manner, punch the channels, angles, and narrow plates used in bridge construction in a very satisfactory manner.

BAR PUNCHING MACHINE FOR 1½ INCH PLATES.

Operated by heavy wrought iron lever within the housing. Independent stop motion by means of a four-toothed clutch in the housing. Blades rest open when the clutch is out of gear. One pulley only on the machine, 42 inches diameter, 12 inches face, making 120 revolutions per minute. The belt should be double. Has 6-feet fly-wheel in addition to pulley.

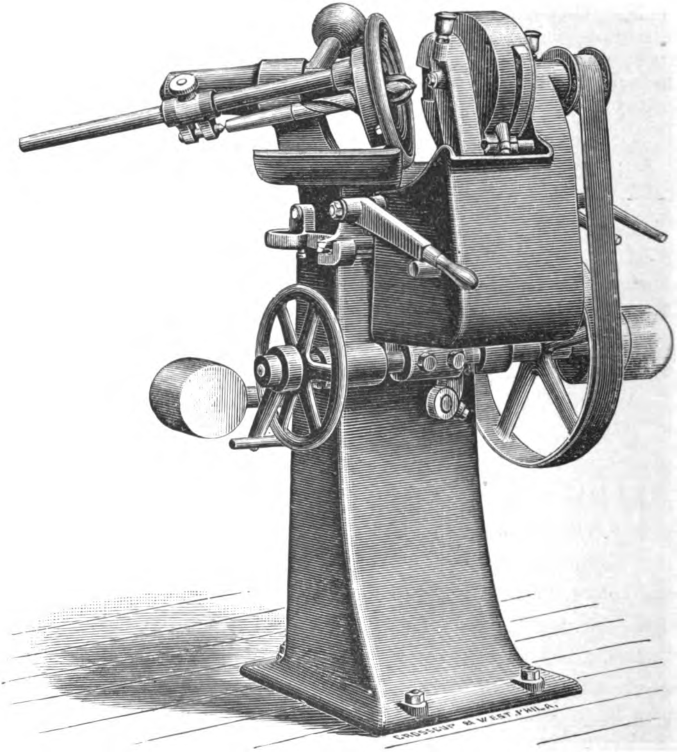
THIS tool is admirably adapted for plate work in car shops, and is the mate to a shearing machine, see page 14, which is for iron of the same thickness, and these machines cover much of work on draw irons and the like. It is usual to place these machines near to the main line and drive direct without any counter-shaft, as the blades can be stopped by the clutch in the machine. For repairs, it is simpler to throw off the belt than to provide any means of stopping the belt. This and similar shearing machines or punching machines can be operated by an engine attached to the machine, when such application is desirable. The manner of attaching the engine is shown on page 15.

No counter-shaft.

Engine attached when required.

The various machines described in the foregoing pages for punching and shearing do not cover all the combinations or changes that can be made to meet the requirements of the two operations, viz., punching and shearing. The form of the housings of our machines enables us to introduce many modifications to meet any special cases that may be presented. The great power and stiffness of the machines make them very well fitted for punching fish plates where four holes are to be made at one stroke. The utmost care has been taken in designing these machines to insure their durability and economy in working.

Fig. 11.


CROSSCUP & WEST PHILA.

WILLIAM SELLERS & CO.'S PATENT DRILL-GRINDING MACHINE.

1st. Holds in the same chuck and in precisely the same manner all kinds of drills, either flat or twist, from one-quarter inch in diameter up to two inches, without requiring any bushings.

2d. It grinds the proper amount of clearance to every part of the cutting edge of the lips. This is theoretically correct on a small drill as well as on a large one.

3d. The lips of the drill form the index to fix the cutting edges in the chuck. This method of placing and of holding the drill insures each lip being ground with the same length of cutting edge.

4th. Adjustable to any angle of drill-point, from 90 to 130 degrees included angle.

5th. Grinds with a flat stone, automatically flooded with water without splash or slop. This abundant and regular supply of water does away with all risk of drawing the temper of the drill while it is being ground.

6th. Nothing is left to the judgment of the workman, who need not be a skilled mechanic.

7th. Wear of parts causes no lost motion.

8th. All parts of these machines are made interchangeable, so that any part of any machine can be duplicated with certainty of fit.

9th. The emery grinding-stone is fixed on a metal ring, which is bolted to the flange of the spindle, without any danger of springing the spindle or of breaking the wheel while clamping it to place. The grinding-wheels can be removed and replaced with very little delay.

10th. Each machine is complete in itself, the fast and loose pulleys on the machine are 5 inches in diameter and 3 inches face, and must be made to run about 560 revolutions per minute. A close approximate to this speed is imperative; a lower speed will not do good grinding, a higher speed may break the stone.

THIS machine, while accomplishing remarkable results, is nevertheless simple in the extreme. It does not require a skilled workman to operate it. Any careful man, who is not too clumsy in his touch, can, with but a few words of instruction, operate it in an unexceptionable manner.

Drills sharpened on it will last longer and do very much more work before requiring to be reground than if dressed with the utmost skill by hand. This is due to the form of the cutting edge produced, which is peculiar to this machine. The clearance obtained is that which has been found to be the best for each part of the cutting edge of the lip, whether close to the centre or at the extreme outside edge; and is totally regardless of the size of the drill, between one-quarter inch and two inches in diameter; as also of the angle of the point, which may be varied anywhere between 90 and 130 degrees included angle.

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Self-Acting Slide Lathes.
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DAS EHREN-DIPLOM
ZUERKANNT.
Der Präs. der K. Ausstell. Comm.:

Wien, 18. Aug. 1873.
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